

CLAIMS

1. An engine diagnostic system, comprising:
a catalytic converter;
an outlet O₂ sensor that generates an outlet signal that is based on an oxygen level of exhaust gases exiting said catalytic converter; and
5 a controller that adjusts a secondary fuel trim based on said outlet signal and that indicates a fault status if said secondary fuel trim is outside of a fuel trim limit range and said outlet signal is out of a diagnostic range.
2. The engine diagnostic system of claim 1 further comprising an inlet O₂ sensor that generates an inlet signal based on an oxygen level of exhaust gases entering said catalytic converter, wherein said inlet signal is biased based on said outlet signal.
3. The engine diagnostic system of claim 2 wherein said secondary fuel trim is outside of said fuel trim limit range when an inlet sensor bias has achieved a bias limit and said outlet signal is outside of a control range.
4. The engine diagnostic system of claim 1 wherein said controller indicates a pass status if a secondary fuel trim within said fuel trim limit range.
5. The engine diagnostic system of claim 1 wherein said controller indicates a pass status if said outlet signal is within said diagnostic range.

6. The engine system of claim 1 wherein said fault for a given sample is indicated if said secondary fuel trim has achieved said fuel trim limit and said outlet signal is out of said diagnostic range.

7. The engine system of claim 1 wherein said fault decision is confirmed if said secondary fuel trim is outside of said fuel trim limit range and said outlet signal is out of said diagnostic range for a threshold period within a monitoring period.

8. The engine system of claim 1 wherein said fault status is indicative of one of a cylinder air to fuel (A/F) ratio imbalance and an exhaust leak.

9. An engine diagnostic system for an engine that produces exhaust that is treated by a catalytic converter and that includes an inlet O₂ sensor that generates an inlet O₂ signal and an outlet O₂ sensor that generates an outlet O₂ signal and a feedback signal to said inlet O₂ sensor comprising:

5 a first comparing circuit that compares an inlet O₂ sensor bias based on said feedback signal to a bias limit range;

a second comparing circuit that compares said outlet O₂ signal to a predetermined control range;

10 a third comparing circuit that compares said outlet O₂ signal to predetermined diagnostic thresholds; and

a decision circuit that generates one of a pass status and a fail status for said engine based on outputs of said first, second and third comparing circuits.

10. The engine diagnostic system of claim 9, wherein said decision circuit generates said pass status when said inlet O₂ sensor bias is inside said bias limit range.

11. The engine diagnostic system of claim 9, wherein said decision circuit generates said pass status when said outlet O₂ sensor signal is within said control range.

12. The engine diagnostic system of claim 9, wherein said decision circuit generates said pass status when said outlet O₂ sensor signal is within said diagnostic threshold.

13. The engine diagnostic system of claim 9, wherein said decision circuit generates said fail status when said inlet O₂ sensor bias is within said bias limit range, said outlet O₂ sensor signal is outside of said control range and said outlet O₂ sensor signal is outside of said
5 diagnostic threshold range.

14. A method of diagnosing engine system performance of an engine system including a catalyst with an inlet oxygen sensor and an outlet oxygen sensor, comprising:
monitoring a secondary fuel trim based on an outlet signal of
5 said outlet oxygen sensor; and
indicating a fault status if said secondary fuel trim outside of a fuel trim limit range and said outlet signal is out of a diagnostic range.

15. The method of claim 14 further comprising monitoring a bias of said inlet oxygen sensor.

16. The method of claim 15 wherein said secondary fuel trim has achieved said fuel trim limit when an inlet sensor bias is outside of said bias limit range and said outlet signal is out side of a control range.

17. The method of claim 14 further comprising indicating a pass status if said secondary fuel trim is within said fuel trim limit range.

18. The method of claim 14 further comprising indicating a pass status if said outlet signal is within said diagnostic range.

19. The method of claim 14 wherein said step of indicating a fault for a given sample comprises:

monitoring occurrences of said secondary fuel trim achieving said fuel trim limit and said outlet signal being out of said diagnostic
5 range; and

indicating said fault for a given sample if said number of occurrences is above a predetermined threshold.

20. The method of claim 14 wherein said step of confirming a fault decision comprises:

monitoring said secondary fuel trim and said outlet signal for a monitoring period; and
5 confirming said fault decision if said secondary fuel trim has achieved said fuel trim limit and said outlet signal is out of said diagnostic range for a threshold period within said monitoring period.

21. The method of claim 14 wherein said fault status is indicative of one of a cylinder air to fuel (A/F) ratio imbalance and an exhaust leak.

22. A method of detecting one of a cylinder air to fuel (A/F) ratio imbalance and an exhaust leak of an engine system having a catalytic converter with an inlet oxygen sensor and an outlet oxygen sensor, comprising:

- 5 monitoring a secondary fuel trim based on an outlet signal of said outlet oxygen sensor;
- monitoring a bias of said inlet oxygen sensor; and
- indicating a pass status if an inlet sensor bias within the bias limits and said outlet signal is within a control range.

23. The method of claim 22 further comprising indicating a pass status if said outlet signal is out of a control range and within a diagnostic range.

24. The method of claim 22 further comprising indicating a fail status if a secondary fuel trim is outside of said fuel trim limits.

25. The method of claim 22 further comprising indicating a pass status if said outlet signal is within said diagnostic range.

26. The method of claim 22 wherein said step of indicating a fault for a given sample comprises:

- monitoring occurrences of said secondary fuel trim achieving said fuel trim limit and said outlet signal being out of said diagnostic
- 5 range; and
- indicating said fault for a given sample if said number of occurrences is above a predetermined threshold.

27. The method of claim 22 wherein said step of confirming a fault decision comprises:

monitoring said secondary fuel trim and said outlet signal for a monitoring period; and

- 5 confirming said fault decision if said secondary fuel trim has achieved said fuel trim limit and said outlet signal is out of said diagnostic range for a threshold period within said monitoring period.

28. The method of claim 22 wherein said fault status is indicative of one of a cylinder air to fuel (A/F) ratio imbalance and an exhaust leak.